

Civil Engineering Design Guide

- **Introduction**

The Appendix "A" defines the scope of A&E services. This Civil Engineering Design Guide further defines the Civil Engineering services identified in the Appendix "A" and identifies our technical and submittal requirements for Civil Engineers doing design work for the Design Division.

- **Communications**

Direct communication with the Atlantic Division Civil reviewer is encouraged. Contact with branch personnel at project inception is recommended. If you have a question concerning a particular comment, contact the Atlantic Division reviewer. This will help to avoid unnecessary re-submittal of plans and specifications due to misunderstood comments. The reviewer's name and phone number can be found on the comment sheets.

- **Pre-Design Services**

- **Field Investigation**

- **Physical and Topographic Surveying of Site**

1. A plotted drawing scale of 1"=25' (1:300 for metric drawings) or 1"=50' (1:600 for metric drawings) is preferred, however, other scales may be used. Site drawings are expected to make best use of the available space on the drawing sheet to clearly indicate all topographic details, utility lines and other pertinent information. Choose the drawing scale based on the size of the site area and level of detail required. Enlargements of specific areas are acceptable.
2. Ensure that adequate adjacent areas are included within the survey limits to clearly indicate and accommodate offsite drainage impacting the project.
3. Provide benchmark (BM) and temporary benchmark (TBM) information. Include note describing BM & TBM type, location, elevations and reference datum. Include sheet number referencing where BM & TBM's are shown on drawings. Use Station datum unless otherwise directed by the Atlantic Division Civil Engineering reviewer.
4. Show all horizontal control used during field survey. Include description of points (pk nail in cap, etc.). Provide multiple reference distances to existing permanent structures (reference points) so that control can be re-established.
5. If horizontal coordinates are used on the plans, provide note stating reference coordinate plane and establish two permanent control points on the ground for reference.
6. Elevations on paved surfaces should be shown to the nearest 0.01' (for metric designs, use 0.005 meters). Elevations on unpaved surfaces to the nearest 0.1' (for metric designs, use 0.050 meters).
7. Provide note with the name of the surveyor and date of survey.

8. Ensure that all symbols associated with the survey are included in the Legend Key. See [Figure 1](#) (Click on Guidance and Policy Tab) for sample legend.
9. If match lines are used involving more than 3 sheets, provide a key map with current sheet highlighted.
10. Remove any extraneous lines and text from Key Map.
11. Provide a north arrow on all plans, details and maps. North should be oriented toward the top (or left edge) of the plotted sheet. Coordinate north direction with other disciplines so that all plans are oriented the same.
12. Provide all graphic scales used on each drawing sheet.
13. Accurately locate (by means of structures visible from the surface and through research of Station utility drawings) the following list of utilities (both above and below the ground), structures, and features. The survey shall include, but is not limited to:
 - Airfield pavements and features
 - Buildings - describe building material, number of stories, entry points of all utility connections, entrances, special access restrictions/requirements, steps, and finish floor elevations.
 - Curbs or Curbs & Gutter - including type of material.
 - Surface Drainage Features (canals, streams, ditches, swales, etc.) - include typical cross sections showing top of bank, toe of slope, changes in grade, bottom width and elevations. Provide sufficient elevations to indicate direction of bottom slope. Indicate current water level and approximate high water level.
 - Electric Power Lines - include power poles, manholes with rim elevations and identification of lines as underground or aboveground.
 - Fences - include height, type of fabric, and note if barbed wire is at the top.
 - Fire Alarm and Lines
 - Foundations - indicate visible foundations of demolished buildings.
 - Fuel Pipes and Storage Tanks - include fill ports, vent lines, tank drains, etc.
 - Marshy Areas - delineate limits of marshes. See item #14 below.
 - Natural Gas Lines - include pipe material and size.
 - Railroads and Crane Rails - include turnouts, rail sizes, compromise joint locations, and curve information (such as P.C., P.T., and P.I.)
 - Roads, Drives, and Parking Lots - include a description of roadway material (bituminous concrete, concrete, etc.). Provide an adequate number of elevations to indicate pavement grades and crowns. Show where pavement demolition is to occur, note pavement thickness and joint patterns for replacement.
 - Sanitary Sewers - include manholes, cleanouts, valves, pump stations, pipe shape, pipe material, pipe size, and all rim and invert elevations. For pump stations include all above ground elements including the wet well, elevation of all entering/exiting piping and utility connections. For projects involving work done to the pump station, obtain a "gas-free" certification from the station

safety officer and obtain pump and motor date from interior of pump station. Note the elevation of wet well high water and low water levels and the inside diameter/dimensions of the wet well. Also provide pump run times, from pump on to pump off to pump on, and time of day when recorded.

- Shoreline - include time of day, wind direction/velocity, and tidal condition noted for each segment of shoreline, if applicable.
 - Sidewalks - include type of material, width and typical thickness.
 - Storm Sewers - include catch basins, manholes, flared end sections, rip-rap stone, curb inlets, headwalls, pipe shape, pipe material, pipe size, and all rim and invert elevations.
 - Steam Lines - include steam pits, manholes, trenches, pipe sizes, rim elevations, and support description and sizes for above ground lines. Identify steam lines as underground or above ground. Locate vertical turns, supports, and height above grade.
 - Telephone and Communication Lines
 - Utility Poles - include guy wires and light fixtures.
 - Utility Structures - include manholes and headwalls.
 - Water Lines - include fire hydrants, valves, PIVs, valve sizes, valve boxes, and storage tanks. Identify system as potable, nonpotable or saltwater if multiple systems exist on the site.
 - Wooded Areas - include type of cover (brush or trees, light or dense), size of trees (label separately if less than 25 trees per acre). Otherwise, give average size and description for densely wooded areas.
14. Wetland Areas - wetland areas will be flagged and numbered by the Government prior to the survey. Locate flags and label in same manner as marked in the field. If unanticipated wetlands are found during the survey, advise the Atlantic Division Civil Engineering reviewer or the Engineer/Architect-in-charge as to the general location and approximate extent of the wetlands.

• Design Services

• Civil Basis of Design

Address the following:

General

Identify the governing codes and criteria including federal and military handbooks being utilized for the design. References may be noted in the related sections listed below. Include reference titles and date of publications. Provide BOD with adequate narrative to describe design logic and assumptions. Show adherence to scope of work.

Existing conditions

- Describe general site topography and vegetation type (grass, lightly wooded, brush). Describe existing site features.

- Verify whether existing footings, foundations, steam pits etc. exist.
- Describe existing soil conditions.
- Indicate known soil contamination issues connected with the site.
- Describe existing utilities, including size, type and general location. Discuss impact that this and future projects will have on utility systems.
- Identify predominant drainage features, including any required downstream improvements. State whether adjacent properties drain to or across the site, and describe the method of drainage (swales ditches, etc.).
- Identify whether site or a portion thereof may be considered wetlands. Identify actions taken to delineate wetlands. State whether field survey has been coordinated with delineation. Indicate the parties that have been notified of the presence of wetlands, and are actively involved in this issue.
- Verify if endangered species inhabit area.
- Identify and describe existing traffic patterns on and around site.
- Provide horizontal and vertical datums and other pertinent survey information.

Demolition

(relating to Civil issues only, typically 5' outside of building line)

Identify all buildings slated to be demolished by building number. Generally describe structure types (1-story frame, 2-story block etc., building specifics should be included under [Architectural](#) (Click on Guidance and policy Tab) BOD. Describe pavement to be demolished, including existing pavement section. Describe underground and overhead utility demolition, relocation and abandonment. Identify clearing and grubbing requirements. Verify if government will harvest timber. Identify actions necessary to coordinate harvesting. Describe other features to be removed (play equipment, fencing, etc.)

New Site Work

Describe new building and its function (with respect to Civil issues such as vehicle ingress/egress, pedestrian movement, etc. Internal functions should be addressed under [Architectural](#) (Click on Guidance and Policy Tab) BOD. Describe pedestrian access. Identify number of parking spaces; include stall and aisle widths. Describe handicap access in and around site, number and size of handicap parking spaces. Identify physical security requirements, such as intrusion detection provisions, fencing type and height, lighting requirements. Identify vehicle type expected on project site, note non-standard vehicle sizes and weights. Identify design wheel loading. Define projected traffic volume. Define new pavement types and sections. For airfield pavement, identify pavement uses, type of aircraft, airfield categories. For railroads, state type of service for which railroad track will be provided; anticipated volume and type of traffic; the ruling grade and the maximum curvature. Describe proposed type, source and thickness of ballast, weight of rail and source, treatment and dimensions of ties.

Grading

Define minimum longitudinal and transverse slopes to be used on concrete and bituminous asphalt pavements, ditches, gutters etc. Indicate 100-year flood elevation with respect to project datum. Indicate the projected finished floor elevation for each facility to be constructed. Discuss whether earthwork cuts and fills will be balanced; if suitable

borrow material is available locally, and options for disposal of excess cut material. Verify existence of a base landfill and whether or not it is available for disposal.

Water Supply

State design parameters; include domestic and fire flow, residual pressure, and recent flow test data. State anticipated demand. Describe water main and supply line sizes, and capacities. Identify connection points. Identify connection methods. Identify whether existing infrastructure has capacity to support project. Identify requirements for backflow protection and freeze protection. Identify needs for metering. Identify need for booster pumps or pressure reducing valves. Identify level of fire protection required for building. Identify number of fire hydrants required by latest fire protection criteria. State number of new hydrants. Provide number of wells and proposed pump rates.

Water Supply Treatment

Briefly describe recommended process, noting deviations from study. State sizes, elevations, capacity, etc., for reservoirs, treatment units, pumping stations, well pumps etc.

Sanitary Sewer

Describe waste stream, and whether it is from domestic or industrial source. Identify design population, peak and average flows. State whether sewer will be gravity or force main. Identify pre-treatment requirements and solutions. State minimum pipe slopes and velocities. Identify special installation requirements. State new pipe sizes and capacities. Identify pump station type, wet/dry well; type of pumps; general horsepower; telemetry requirements and compatibility with existing on-base systems; backup power requirements; and assumed response time by Base Operation staff. Consult Activity and Atlantic Division Base Operations Utilities Engineering Branch, Code BE3 as to whether existing system is operating at or near capacity. Discuss adequacy of existing system to handle current and future flows.

Sewage Treatment

Identify completed treatability studies. Briefly describe recommended process noting deviations from the treatability study. Define impact of steam condensation and cooling water discharges on sewer piping and treatment plants and the estimated cost of distribution and treatment of this additional loading.

Storm Drainage System

Identify receiving waters, classification (if applicable), storm frequency, C factors etc. Discuss adequacy of existing storm system and its effects on downstream facilities and systems. Discuss whether existing system will require upgrades. Identify use of collection system vs. sheet flow. Describe materials and pipe sizes. Describe how upstream flows that impact site will be handled.

Storm Water Management

Discuss best management practices (BMP's) and approach to storm water management. Discuss compliance with Activity, State & Local requirements.

Erosion & Sediment Control

Identify total disturbed area acreage. Discuss erodibility of soil, devices or methods to be used to control erosion & sediment losses, and protection devices at outfalls. Discuss compliance with Activity, State & Local requirements.

Environmental Permits

Identify the permits necessary for both construction and operation of facilities. Identify fees associated with each permit. Identify which permits will be obtained by A&E and which will be obtained by construction contractor and government.

Antiterrorism/ Force Protection (AT/FP)

Identify the type of building (Billeting, Inhabited, or Primary Gathering) discussing minimum standoff distances from controlled perimeter, parking and roadways, trash containers and other buildings. Discuss unobstructed space, drive-up / drop-off and access roads, site planning, and any special concerns. Discuss how the site plan layout meets the AT/FP standards. See most recent copy of Department of Defense Antiterrorism Minimum Construction Standards for Buildings for [Department of Defense Antiterrorism / Force Protection Standards](#) (Click on Guidance and Policy Tab).

- **Civil Calculations**

Refer to the appropriate design submittal phase below for civil calculation requirements.

- **Civil Drawings**

Cover Sheet, Drawing Index, Vicinity Map, Location Plan, Abbreviations, Legend, and Notes, or First Civil Sheet

General - If project is not a Civil Engineering lead, assure that the following items are coordinated with the lead discipline responsible for creating cover sheet.

1. If General Development Maps (GDM) are used for the Vicinity and Location Maps, they must be edited for the specific project being designed. Ensure street names, main gates, and the Public Works office of the base are identified. Ensure that text is legible at the plotted scale, and remove extraneous lines.
2. The Vicinity Map should identify the Activity and have enough main highway names and street names to allow an out of town contractor to locate the work.
3. The Location Plan should allow the contractor to find the project on the base. This is generally a good place to show laydown areas, any construction traffic routing restrictions, and off-site benchmark locations. Provide an adequate amount of street names to allow coordination between the Vicinity Map and the construction plans.
4. In general, it is desirable to show the Vicinity Map and the Location Plan on the Cover Sheet along with the project title.
5. Coordinate with ROICC and Activity for laydown area.
6. Standard details, abbreviations, legends, and general notes must be edited for the specific project being designed.
7. A single Civil legend should be provided on one sheet (preferably sheet C-1). See [Figure 1](#) (Click on Guidance and Policy Tab) for sample legend.

8. Provide north arrows and graphic scales on all applicable drawings.
9. For projects near tidal waters, show datum sketch indicating project vertical datum and relationship to range of tide and other important datums.

Demolition Plan

1. Clearly show what is to be demolished, at an appropriate scale. Coordinate/edit the legend to match the demolition plans.
2. Indicate the beginning and ending points of utility removals, methods of plugging pipes (cap, brick & mortar etc.). Show location of valves to be used for isolating work.
3. Show limit of pavement removal as required for utility work.
4. Describe the existing items in detail with supplemental descriptions if necessary. Indicate depth of pavements/bases to allow uniform contractor bids.
5. Provide a sequence of demolition, if necessary. Include any known requirement for continuous operation and limited shutdown requirements. These should be identified in the special scheduling paragraphs of the specification.
6. Any items that are being demolished with the current project shall not be shown on subsequent Civil plan sheets

Layout Plan

1. Label baselines to be used for project layout as 'construction baseline' as opposed to survey baseline.
2. Provide layout dimensions from the construction baseline, or another readily identified (and easily established) alignment in the field. Include horizontal control point locations and descriptions. Use of coordinates for layout purposes is discouraged, however may be considered on a case by case basis. Contact Atlantic Division Civil Engineering reviewer for approval prior to project submittal.
3. Show areas requiring pavement patching.
4. Eliminate extraneous items that may congest the drawing (contours, elevations, etc.) and detract from the layout information.

Grading and Drainage Plan

1. Provide **existing** spot elevations and **existing** contours to clearly indicate **existing** drainage patterns
2. Provide **new** spot elevations and **new** contours to clearly indicate **new** grading and drainage patterns.
3. Indicate where new grading ties to existing grading (limits), and verify that new work will not block existing adjacent drainage.
4. Show all benchmarks, tbm's, other vertical control and datum notes on this plan.
5. Show finish floor elevations on grading plans. Do not show finish floor elevations on the architectural or structural plans, in order to avoid conflicts. Coordinate adjacent exterior grading with the architectural/structural plans to ensure positive drainage patterns away from the building.
6. Verify that the slopes indicated on the plans are suitable for the surface material involved, i.e. earth slopes, bituminous pavements and concrete pavements. Consider

if these slopes are maintainable for the service life of the facility. The preferred minimum pavement slope is 2.0% for non-airfield pavements. Ensure that the Military Handbook design guidance (the former NAVFAC Design Manuals) has been met with respect to allowable minimum slopes, i.e. providing a 5% slope away from the facility for a distance of 10 feet.

7. Coordinate with the Landscaping Plans (L sheets) to prevent new plantings from blocking site drainage.
8. Provide numbers (or letters) for each structure so that plans and profiles are easily coordinated.

Water and Sanitary Sewer Plan

1. Indicate whether new connections will be made by wet tap (tapping sleeve/valve) or by dry connection. Show nearest valve(s) for system isolation if the latter is the case. Indicate known scheduling issues in the special scheduling paragraphs of the specification.
2. Indicate surface materials (i.e., grass, bituminous, concrete, etc.).
3. Provide numbers (or letters) for each structure so that plans and profiles are easily coordinated. This labeling system shall be clearly distinct from that used for the storm drainage system, and preferably distinct from labels used by other utility systems, i.e. electrical, etc.

Erosion/Sedimentation Control Plan (E&SC)

1. Show locations of all E&SC control items. Show erosion control details on drawings or refer to applicable detail in the Erosion and Sediment Control Handbook or manual for the particular state.
2. Verify that the erosion control legend is edited and is clear. Assure Erosion Control symbology is coordinated with E&SC plan.

Water, Storm, and Sanitary Sewer Profiles

1. Profiles may be required for utility lines. Discuss profile requirements with Atlantic Division Civil reviewer.
2. Indicate structure tops, pipe invert elevations, slopes, lengths and diameters of all new gravity lines.
3. Coordinate structure numbers with plan sheets.
4. Reference the plan sheets where pipes/structures are shown.
5. Show and label existing and new surface materials, concrete pads, curbs, roads, etc. traversed by the new lines. Accurately show depth of existing pavements.
6. Show and label all crossing utility lines, both existing and new.
7. If depths of existing utilities are unknown, indicate the horizontal location of the utility and indicate the vertical location with a line representing the anticipated range of elevations where the utility will be found in the field. Indicate the method of new utility installation routing above or below conflicts, i.e. concrete encasement, pressure pipe, etc.

Site/Utility Details

1. Edit and update standard details to apply to the particular conditions found in this project. Note: This includes Atlantic Division supplied "standard" details.
2. Details of items shown in the construction standards of the Department of Transportation for the state in which the project will be built are not mandatory on the plans. However, clear and adequate references to those standards shall be made on the drawings where they will be applied and complete (specific) data provided for all detail variables shown in the standards. Thorough reference to these standards must be included in the specifications. Standard construction details published by other state agencies may be referenced if previous approval has been obtained from the Atlantic Division Civil Engineering reviewer.
3. Use detail bubbles used. Numbers shall be used for section references and letters for detail references. Note that details identified as "typical" do not require bubbles. Conform to the requirements of the [Electronic Bid Solicitation - Manual of Policies and Procedures](#) (Click on Guidance and Policy Tab) for all other details and sections.

- **Permits**

- **Procedure for Submitting Stormwater Management Permit Application for Projects in North Carolina and Virginia**

NORTH CAROLINA: A storm water management permit is required for nearly all projects. Refer to North Carolina Administrative Rule 15A NCAC 024.1003 to verify specific requirements. Administrative Rules may be accessed via the Internet at <http://mapsweb01.sips.state.nc.us/ncoah/default.htm>.

Permit applications must be accompanied by the fee required by the State reviewing agency. Contact the appropriate NCDENR office to determine the current fee rate. Permit applications and information can be obtained from NCDENR Division of Water Quality and accessed via the Internet at <http://h2o.enr.state.nc.us/wqs/>.

- Submittal and Distribution Procedure:
 - Prior to project prefinal (100%) completion, complete application and submit one copy to the Director of Public Works at Camp Lejeune or Cherry Point to obtain signatures. Application must be complete and must contain signed and sealed drawings, specifications, basis of design/calculations, and other documents as required by the State.
 - After the signatures are obtained, forward the original and two copies of the signed permit application, including forwarding letter, to NCDENR. Forward one copy of the permit application and project pre final design to Atlantic Division Project Manager for review at this time also.
 - When approval of permit application is received from State of NC, forward to the Atlantic Division Project Manager.

VIRGINIA: There are no general requirements to prepare a storm water management plan for projects in Virginia. The Atlantic Division may however cooperate with local agencies and city governments in providing stormwater management to meet local regulations. These special requirements will be noted in your Scope of Work. Information on Virginia stormwater management regulations may be accessed via the Internet at <http://www.state.va.us/%7Edcr/sw/stormwat.htm>

The Atlantic Division civil reviewer can provide additional guidance in obtaining storm water management permit application approvals in North Carolina and Virginia.

- **Procedure for Submitting Erosion/Sedimentation Control Permit Application for Projects in North Carolina and Virginia**

NORTH CAROLINA: An erosion/sedimentation control plan is required for nearly all projects. Refer to North Carolina Administrative Rule 15A NCAC 4B to verify specific requirements. Administrative Rules may be accessed via the Internet at <http://www.dlr.enr.state.nc.us/erorules.html>

- Permit applications must be accompanied by the fee required by the State reviewing agency. Contact the appropriate NCDENR office to determine the current fee rate. Permit applications and information can be obtained from NCDENR Division of Land Resources, Land Quality Section and accessed via the internet at <http://www.dlr.enr.state.nc.us/eros.html>
- Submittal and Distribution Procedure:
 - Prior to project 100% (prefinal) completion, complete permit application and submit one copy to Director of Public Works to obtain signatures on application. Application must be complete and must contain signed drawing, specifications, basis of design/calculations, and other documents required by the State
 - After the signatures are obtained, forward the original and two copies of the signed permit application, including forwarding letter, to NCDENR. Forward one copy of the permit application and project pre final design to Atlantic Division Project Manager for review at this time also. When approval of permit application is received from State of NC, forward that approval letter to Atlantic Division Project Manager.

VIRGINIA: Virginia Department of Soil Conservation Service has delegated approval authority to the Atlantic Division to approve all erosion and sedimentation plans for projects in Virginia. Submit an erosion and sedimentation plan to Atlantic Division as part of your project design review package. www.state.va.us/~dcr/sw/e&s.htm

The Atlantic Division civil reviewer can provide additional guidance in obtaining erosion and sedimentation control permit application approvals in North Carolina and Virginia.

- **Procedure for Water, Sanitary Sewer and Sewage Pumping Station Permit Application Projects in North Carolina and Virginia**

NORTH CAROLINA: Permit applications for water and sewer extensions as well as new sewage pumping stations are required. (Note: A permit for sewage pumping stations may not be required. Review the state permit requirements at <http://h2o.enr.state.nc.us/ndpu/ndpupol.html> - permit)

- Prior to submittal of the permit application package, all downstream surface water classifications must be determined by the appropriate North Carolina Department of Environmental Management (DEM) regional office. Contact DEM to determine when this classification must be obtained in order to submit a complete permit package at the prefinal design stage.

- Permit applications must be accompanied by the fee required by the State reviewing agency. Contact the appropriate NCDENR office to determine the current fee rate.
- Submittal and Distribution Procedure:
 - When the prefinal design package (100%) is submitted to Atlantic Division for approval, submit the original and four copies of the permit applications to Atlantic Division Project Manager. Applications must be complete and must contain signed and sealed drawings, specifications, basis of design/calculations, and other documents as required by the State.
 - Atlantic Division Project Manager will obtain the appropriate signatures, and send the permit applications to the appropriate Atlantic Division department, which will forward the application to State of North Carolina Department of Environment and Natural Resources. Approval letters will be forwarded to Atlantic Division Project Manager.
 - If the State of NC requires corrections to the permit application for approval, the application will be returned to you for your action. Re-submit corrected applications to the Atlantic Division Project Manager as stated above.

VIRGINIA: Permit applications for water and sewer extensions and sewage pumping stations are required to be sent to the local Virginia Health Department. Use the same process as outlined above for North Carolina when you submit your permit applications to the Atlantic Division Project Manager.

- Visit the North Carolina DENR website at: <http://h20.enr.state.nc.us/ndpu> for wastewater regulations and application forms.
- Visit the North Carolina DENR website at <http://www.deh.enr.state.nc.us/pws> for water supply regulations and application forms.
- Guidance in preparing and submitting permit applications for sewer and sewage pumping stations in North Carolina and Virginia can be obtained from the Atlantic Division, Environmental Engineering Branch, Code EV12.
- Guidance in preparing and submitting permit applications for water supply extensions in North Carolina and Virginia can be obtained from the Atlantic Division, Environmental Engineering Branch, Code EV11.

AE shall verify all permit & application forms are current.

• **Design Submittals**

• **35% Design Development Submittal**

• **Basis of Design**

Provide adequate narrative to describe the design logic and assumptions.

• **Drawings.**

- Completed physical and topographic survey
- Demolition plan.
- Site plan. Show: new building locations with approximate finished floor elevation; new walks, parking areas, roads, entrances and connection to existing road network; stormwater management pond location; new storm, sanitary sewer, and water piping routes including point of connection to existing utilities. Show layout to meet minimum AT/FP standards.
- **Calculations.**
 - Copies of all preliminary sizing calculations as applicable to items shown on the plans. If plans show layout of pumps and tanks within building, then provide calculations as to how those items were sized.
 - Discuss methodology used to develop preliminary calculations, list all assumptions and known conditions.
- **100% Submittal (Prefinal)**
 - **Basis of Design**

Certain projects may require an updated BOD. Refer to your Appendix A for information. The updated Basis of Design should reflect changes in design philosophy from the 35% submittal. If a 35% submittal was not required, provide a limited BOD that discusses special systems such as pump stations, treatment systems etc. When a 35% submittal is not required the A&E should review the 35% BOD requirements to make sure that all elements are considered in the development of the design and 100% drawings.
 - **Drawings**

Provide completed to the extent that they may be released for bid as submitted.
 - **Calculations.**

Submit calculations to support all utility systems. If a utility is sized based on a previous study, provide applicable portions of that study. Provide pressure & flow test data, proving that pipes are properly sized; service area map showing future/existing areas and projected flows from each area; storm sewer calculations in tabular format similar to that shown in VDOT Drainage Manual; culvert sizing, tailwater/headwater data. Provide revisions to calculations submitted to State Agencies. If computer programs are used, document methodology of program, include data inputs and program results, do not provide print out of program runs. Provide drainage area maps (to scale), with each area highlighted and labeled, include offsite drainage areas.
 - **Erosion & Sediment Control Narrative.**

LANTDIV is the reviewing agency for erosion & sediment control plans in Virginia. Provide narrative discussing erosion control measures.

- **Additional Data**

Pump Curves

Provide pump curve for selected pump. Plot system head curve for new and aged system, with at least 2 points on system head curve.

Catalog Cuts

Provide catalog cuts for special items such as pumps, pump stations, treatment systems etc.

Permits

Provide copies of all permits received from State Agencies.

- **Final Submittal**

1. Assure Quality Review block on title sheet is signed, and marked QR prints are submitted to the Atlantic Division.
2. Obtain "Sat-to" signature on the title sheet (coordinate with the Atlantic Division Project Manager).
3. Submit the final revised and or updated calculations.
4. All permits should be approved and on file with the Atlantic Division Project Manager.